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CRITERIA FOR RELEASE OF REHABILITATED MARINE MAMMALS

Pierre-Yves Daoust[1]

[1] Canadian Wildlife Health Cooperative
Atlantic Veterinary College
University of Prince Edward Island
550 University Avenue
Charlottetown, PE C1A 4P3

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Foreword

This series documents the scientific basis for the evaluation of aquatic resources and ecosystems in Canada. As such, it addresses the issues of the day in the time frames required and the documents it contains are not intended as definitive statements on the subjects addressed but rather as progress reports on ongoing investigations.

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ABSTRACT

Guidelines on best practice with respect to release of rehabilitated marine mammals into Canadian waters are provided in this document. Guidelines or procedures at other marine mammal holding facilities, in other jurisdictions, or as recommended by international organizations were examined in order to formulate release criteria in light of the Canadian situation. Recommendations on release of rehabilitated marine mammals are developed with the objectives of optimising the welfare and survival of released individual, protecting wild populations, including those used by Indigenous peoples, ensuring public safety, and preventing attempts at wild animal rehabilitation and release by untrained individuals. Release of marine mammals born in captivity and of captive marine mammals held for public display for extended periods of time is not recommended. Strict quarantine measures must be in place within the institution to minimize the chances of pathogen transmission among animals and between animals and humans. Rehabilitation programs should include a post-release identification and monitoring plan to determine as best as possible the outcomes of rehabilitation efforts.

A. INTRODUCTION

The benefits and risks of rehabilitating and releasing marine mammals have been largely described (e.g., Measures 2004; Moore et al. 2007). Most people involved in wildlife rehabilitation agree that this activity is rarely of direct benefit from a conservation perspective and that rehabilitated animals make no significant numerical contribution to wild populations that are not endangered (Measures 2004). Wildlife rehabilitation can nonetheless have a number of positive outcomes (Measures 2004), including the opportunity to compensate to some degree for the consequences of negative anthropogenic impacts, directly on individual animals and indirectly on populations as a whole through public education and research (Osinga and 't Hart 2010).

Irrespective of the ethics, human values, and relative merits of scientific advances supporting or opposing rehabilitation efforts, a general agreement on marine mammal rehabilitation and release is the need for objective, well-established guidelines on best practice. This document focuses on best practices for release following rehabilitation, rather than on standards of rehabilitation, and aims to ensure that the release of rehabilitated animals does not threaten the integrity of wild populations and the ecosystem in which they live, and is consistent with the concepts of animal welfare. A common consensus in the literature on marine mammal rehabilitation and release is that the health of wild populations has precedence over the welfare of individual animals (St. Aubin et al. 1996). Yet, the public's attention is primarily focussed towards the well-being of individuals, especially if they are suffering. In this context, strong national guidelines providing structured decision-making frameworks can also transfer some of the burden of decisions associated with divergent public reactions from rehabilitation centers (RCs) to the dedicated government agency.

Rehabilitation of marine mammals occurs in some regions of Canada, however there are no existing national policies regarding the release of rescued and rehabilitated marine mammals into Canadian waters. Key legislation pertinent to marine mammals in Canada was outlined in Measures (2004). Fisheries and Oceans Canada (DFO) is responsible for the protection, conservation and management of marine mammals, which includes authorizing the transfer and release of rehabilitated marine mammals into Canadian waters under section 56 of the *Fishery (General) Regulations*. Science advice is required to inform DFO managers of appropriate policy approaches and licence condition requirements for institutions involved with the rehabilitation and release of marine mammal species. The aim of this research document is to propose Canadian guidelines for the release of rehabilitated marine mammals, with the objectives of minimizing risks to wild populations, optimizing survival of released individuals, ensuring public safety, and preventing attempts at marine mammal rehabilitation and release by untrained individuals. The guidelines detailed in the present document are based on a review of protocols and procedures adopted at various marine mammal holding facilities, guidelines in place in other jurisdictions, and recommendations from international organizations.

The purposes of this research document are to:

1. propose general criteria for release of marine mammals, addressing the issues of concern pertinent to this practice in Canada;
2. propose requirements and recommendations for release site selection; and
3. propose requirements and recommendations for post-release monitoring.

As per CCAC (2014), throughout this document, the term 'should' is used to indicate a proposed obligation for which exceptions must be justified to proper DFO authorities, whereas the term 'must' is used for proposed mandatory requirements.

The guidelines recommended in the present document do not concern the immediate release of marine mammals following capture for health assessment or sampling approved by a research protocol, disentanglement, emergency assistance during mass stranding events, or move to a new location for reasons of public safety. They concern marine mammals captured in the wild because of concern for their well-being, admitted to a compliant RC and initially identified as potentially releasable by a veterinarian or appropriately trained animal care personnel.

B. RECOMMENDATIONS ON THE RELEASE OF REHABILITATED MARINE MAMMALS

I. GENERAL CONSIDERATIONS

A number of authorities, marine mammal RCs, zoological associations, and non-governmental organizations or specialists provide guidelines, advice, or specific criteria enabling return or re-introduction of animals to the wild. These include IUCN (1998), Measures (2004), Geraci and Lounsbury (2005), CCAC (2003, 2014), NOAA (2009a,b), Osinga & `t Hart (2010) (Seal Rehabilitation and Research Centre, Pieterburen, The Netherlands), VAMMRC (2010), MacRae et al. (2011), CWSS (2012), IUCN/SSC (2013), and The Marine Mammal Center (Sausalito, CA, USA). The many commonalities among these various sources demonstrate general agreement on best practice that should inform the Canadian situation. Canada has large, generally healthy populations of marine mammals, some of which are commercially exploited or represent an important source of food for Indigenous people. There is still inadequate knowledge of most marine mammal diseases, particularly in Canada, and further study of the health and diseases of wild Canadian marine mammal populations (including non-stranded animals) should continue. Thus, recommendations and release criteria presented in this document were developed by using an amalgam of the guidelines provided in the above documents, taking into consideration threats and risks posed by rehabilitation and release of marine mammals, standard operating procedures (SOPs) of existing RCs, and review of the literature.

With respect to marine mammals born in captivity, there is a general consensus that these animals, especially cetaceans, should not be released to the wild (McBain 1999; Corkeron 2002; EAAM 2010; CWSS 2012; CCAC 2014; Alliance of Marine Mammal Parks and Aquariums, http://www.ammpa.org/faqs). Exceptions may be considered after analysis and review if there is a significant conservation need such as supporting a highly endangered or threatened species through captive-breeding programs, although such exceptions may entail risks for the individual animal, the population, the ecosystem, and possibly humans (IUCN 1998; IUCN/SSC 2013). The same may be said of marine mammals captured in the wild and held for extended periods of time for public display in zoological parks or aquariums, especially when these animals have shared the same captive environment with a variety of other animal species, some of them possibly of exotic origin and thus potential hosts of pathogens exotic to the region. Thus, it is advisable for the welfare of the animal and potential risk to wild populations that marine mammals born in captivity or captured in the wild (including cetaceans, pinnipeds, and sea otters) and held for extended periods of time (see below) for public display should remain captive for the rest of their lives and not be released to the wild.

The duration of rehabilitation should be kept to a minimum.

a. Notwithstanding the quality of a RC's SOPs, captivity may represent a stressful situation for a wild animal, which, combined with the proximity of other captive animals, increases the likelihood of disease transmission. A prolonged stay may also lead to habituation to human presence and food provision. This may in turn decrease the animal's self-reliance; it may also decrease its fear of humans, which could lead to encounters with negative

consequences, either for the animal or for humans, following its release back into the wild.

b. The maximum recommended duration of rehabilitation is influenced by the species involved. For example, most protocols consider that seals should be released within 4-6 months of capture, unless consultation between animal care personnel and the attending veterinarian suggests otherwise (CWSS 2012; Measures 2004; NOAA 2009b; Osinga and 't Hart 2010). In contrast, it may be months to a year before a cetacean can be released (Geraci and Lounsbury 2005), and sea otter pups, which are dependent on their mother for the first 6 months of life (NOAA 2009b), are not considered releasable unless reared by surrogate otter mothers.

c. According to the Guidelines provided by NOAA (2009b), cetaceans and pinnipeds are deemed "non-releasable" if they have been in captivity for more than 2 years. Although there are few scientific data that indicate an upper limit for a period of captivity prior to release, this 2-year period appears to be a reasonable limit for most circumstances, until further data become available from post-release monitoring.

Any animal considered for release should have a detailed health report describing case history (stranding details and circumstances, age, sex), suitability for release (i.e., attestation of fulfillment of the criteria detailed below), proposed release plan, and post-release monitoring and response strategy. This report should be prepared by the attending veterinarian, in consultation with the RC's animal care personnel and preferably with one or more marine mammal biologists with knowledge of the species or similar species under consideration, and it should be submitted to a Release Evaluation Committee (REC) for evaluation. This evaluation should in turn be done in a timely manner in order to minimize the animal's time in captivity. The REC may consist of one or more independent experienced marine mammal veterinarians, marine mammal biologists, and DFO conservation managers. If the candidate is deemed releasable by the REC (i.e., all of the release criteria have been met), a release permit must be issued by the proper DFO authorities. The ultimate decision concerning release of a marine mammal to Canadian waters is indeed the responsibility of DFO (CCAC 2014). Some rehabilitation cases are of a standard and predictable nature, e.g., the annual cluster of abandoned or orphan seal pups for which the problem and SOPs for rehabilitation, release, and post-release monitoring can be well defined. In such cases, it should be possible for the RC to obtain a blanket authorization to handle them without the need to submit a specific report on each individual case (NOAA 2009b).

II. CRITERIA

Assuming that the general principles outlined in the previous section have been adhered to, suitability for release of marine mammals can be divided into four general categories, each based on specific requirements as listed below. According to the terminology used by NOAA (2009b), individual animals which do not meet these criteria are categorized as "conditionally releasable" if the requirements for release cannot yet be met but may be met in the future, provided that time spent in captivity will not be excessive, or they are categorized as "non-releasable", in which case euthanasia or permanent captivity in a zoological park, aquarium or research facility is necessary.

1. The release candidate was rehabilitated in an appropriate rehabilitation center

Extensive details on operational requirements whereby a RC can be deemed to be appropriate are beyond the scope of this document. However, they are clearly outlined in the "CCAC Guidelines on: the care and use of marine mammals" (CCAC 2014), which pertains to all marine

mammals held in captivity, whether for public display, scientific research, or rehabilitation. These guidelines provide principles of best practice and must be adhered to by all RCs. Listed below are some basic requirements defining an adequate RC in which a marine mammal candidate for release in the wild must have been rehabilitated.

a. The RC must hold the required permits (whether federal, provincial/territorial, or municipal), respect their restrictions, and meet standards regarding marine mammal housing, husbandry and feeding (Coakley and Crawford 1998; Huguenin et al. 2003; Couquiaud 2005; NOAA 2009a; CCAC 2014). This implies up-to-date SOPs, good clinical practices, health and safety protocols, and appropriate training for all staff and volunteers. This also implies that the RC must have access to a licensed veterinarian with expertise in marine mammal medicine. If this veterinarian acts as consultant who may not be physically present at the institution on any regular basis, this veterinarian must be available to give advice to a local licensed veterinarian who is readily accessible to the RC and can provide the basic clinical care and emergency needs of the animals in the facility (CCAC 2014).

b. The RC should have an Animal Care Committee operating within the guidelines of the CCAC (2003, 2014).

c. The RC as an institution may operate different facilities, defined as self-contained units that can allow complete isolation within the institution, including air and water flows and biosafety measures independent from those of other facilities. Based on this definition, the RC must not hold in the same facility marine mammals and non-marine species because of the risk of transmission of new pathogens from a non-marine environment (Geraci and Lounsbury 2005; NOAA 2009b). For example, canine morbillivirus, which can infect canids, mustelids and raccoons, has been identified as a cause of mortality outbreaks in free-living seals (Mamaev et al. 1995; Kennedy et al. 2000). For similar reasons, the RC must not hold in the same facility species of marine animals that are not normally found in the region, due to potential risks of transmitting exotic pathogens. If an institution maintains different facilities holding multiple species, strict quarantine measures (NOAA 2009a; CCAC 2014) must be in place to isolate marine mammals from non-marine species or marine species not indigenous to the region. CCAC (2014) provides detailed information on the design of effective marine mammal facilities.

d. In order to avoid the possibility of habituation to humans by the animals intended for release, facilities holding marine mammals in a RC should adopt and enforce the necessary protocols in exhibit design, handling, feeding, public viewing, and research.

e. Although some pathogens carried by animals can cause disease in humans (zoonoses), the reverse may also occur (anthroponoses). Staff and volunteers working in a RC must therefore minimize the chances of any pathogen transmission by using proper protective equipment and following proper animal handling protocols. They should be adequately immunized against common communicable diseases such as measles and varicella (chickenpox), in the remote possibility that viruses causing these diseases could be transmitted to individual animals of other mammalian species. Anyone with a current infectious illness, particularly influenza and infection by methicillin-resistant *Staphylococcus aureus*, or having recently been in contact with someone suffering from a communicable disease should refrain from working with the animals. For example, influenza B virus, which was originally thought to be restricted to humans, has been circulating for some time among harbour seals and grey seals living in Dutch coastal waters, suggesting that this virus was at some point introduced into populations of these seals (Bodewes et al. 2013).

f. Animals dying or euthanized in the RC should have a thorough necropsy by a qualified veterinary pathologist, preferably with marine mammal experience, especially if an infectious disease is suspected.

g. At year-end, the RC must report to the proper DFO authorities the species, numbers and disposition of all handled animals, as well as results from post-release monitoring programs and post-mortem examinations.

2. The release candidate is healthy

The attending veterinarian, in consultation with animal care personnel, is responsible for preparing the candidate's health report which should be provided in writing to the proper DFO authorities, unless a blanket authorization to handle rehabilitation cases of a standard nature has been obtained (see: I. General considerations). The following should be considered for all potential release candidates:

a. A medical history of the candidate is available and should include: any indication that the animal has previously been rehabilitated and released, health assessment, treatment, husbandry while in captivity, time in rehabilitation.

b. The candidate was not originally presented to the RC with clinical signs suggestive of a contagious infectious disease (such as, but not limited to, distemper [morbillivirus] and influenza) that could represent a risk to free-living wildlife populations.

c. The candidate is in good body condition, i.e., body mass at age and sex falls within the species' normal range. See Table 1 for normal body masses at weaning and for adult sea otters, pinnipeds and cetaceans for which rehabilitation may be attempted in Canada.

d. Pre-release medical health assessment has revealed no abnormalities that could compromise the candidate's survival and no infectious disease that could represent a risk to free-living wildlife. This includes a complete health screen within 2 weeks of the expected day of release and a hands-on physical exam by the attending veterinarian or by trained veterinary staff within 72 hours prior to release. The health screen should include blood collection for complete blood cell count and chemistry profile (electrolytes, enzymes, blood urea nitrogen, creatinine), and the results should be evaluated by the attending veterinarian. See Dierauf et al. (2018) for references for species-specific normal ranges of blood parameters. Individual RCs are encouraged to establish through a systematic health screen of animals brought to their facility normal ranges of values for their local populations of marine mammals. They are also encouraged to archive serum samples (minimum of 3 ml) at -20°C upon admission of the animal and prior to its release. The proper DFO authorities may request additional testing based on the threat of current or emerging infectious diseases specific to the region.

e. If the candidate has been administered drugs during its time in rehabilitation, the withdrawal time period for these drugs must be sought and should be used to assess release date. Because all of the drugs used in wild animals are "extra-label", their withdrawal times have not been determined for these species. It is nonetheless incumbent on the attending veterinarian to seek the best available information on this matter, at least as it relates to domestic animals (CCAC 2003, 2014; CVMA 2015). However, maintaining the candidate in captivity until an appropriate withdrawal time for all drugs that it has received has passed may not be practical or desirable, for example, if sedatives need to be used during transport or to facilitate physical examination prior to release. This emphasizes the importance of identifying the animal prior to its release as a

potential warning to hunters that it may carry drug residues (see Section D). With the possible exception of sedatives, a minimum period of 2 weeks following drug administration should elapse before an animal held in captivity can be released to ensure that drug residues do not enter the food chain.

f. The RC should maintain medical history reports on individual animals for a minimum of 5 years post-release.

3. The release does not pose serious risks to the candidate's welfare

This criterion refers to the candidate's ability to survive in the wild. Ideally, rehabilitated animals would be able to demonstrate adequate foraging and social skills prior to their release. This includes the ability to chase, capture, and consume live preys that are normally found in their natural environment. For sea otters, it also involves the ability to use tools to open shelled prey. For (toothed) cetaceans, NOAA (2009b) recommends that a hydrophone-recording system be used to document production of normal classes and qualities of underwater sounds made by the animal when feeding. Adequate social skills refer to normal interactions with conspecifics. This may include the ability to compete with pool mates when catching live preys, but in some social cetacean species it may be more important to look for cooperative or coordinated feeding behavior and other forms of social organization (NOAA 2009b). However, adequate assessment of these foraging and social skills may be limited substantially by the confines of the temporary captive environment in which the animals find themselves. To achieve an optimal evaluation of these skills, it is therefore important to involve different sets of expertise, including the attending veterinarian, the animal care personnel, and a biologist with species-specific knowledge of behaviour and ecology. Such evaluation is especially pertinent since behaviour and health often overlap and since abnormal behaviour may indicate an underlying disease process.

More specifically:

a. If recently born, the candidate must be weaned and nutritionally independent. See NOAA (2009b, Appendix I) for approximate age and length at weaning by species of cetaceans and pinnipeds.

Cetaceans:

i. Calves that strand without their mother and are nutritionally dependent when admitted to the RC are not releasable.

ii. In the case of a mother-calf pair, the calf may be released with its mother if both are deemed releasable based on all other criteria.

Pinnipeds:

i. Phocid and otariid pups should be held in rehabilitation until they reach their weaning age and appropriate body mass, which can vary greatly among species, unless the mother and her pup stranded together, were rehabilitated, and are released together.

ii. Among phocid species in general, especially grey seals, harp seals, and hooded seals, no apprenticeship is provided by the mother to its pup during or after the nursing period, and there would be limited concern in releasing these young animals after they have reached their weaning age and if their body mass falls within the species' normal range for that age. In some species such as bearded, harbour and ringed seals, pups will often follow the females while they are foraging, suggesting that there may be some opportunities for learning.

iii. Otariid pups generally have a prolonged nursing period (more than 1 year in some individuals) when they develop their swimming and foraging skills. Demonstration of these skills prior to release is essential in these animals. It may therefore not be possible to release pups of some species because of the long period of captivity before they can demonstrate these skills.

iv. Walrus that strand as calves are not releasable because of the long period of maternal care (2 years old at weaning) (NOAA 2009b) and very social nature of this species.

Sea otters:

i. Sea otter pups are dependent on their mother for the first 6 months of life (NOAA 2009b) and are not considered releasable, unless they are reared by surrogate otter mothers.

b. The candidate must not demonstrate evidence of habituation or attraction to humans which otherwise could lead to encounters with negative consequences, either for the animal or for humans, following its release. The time spent in the RC and interactions between animal care personnel and the animal must therefore be kept to a minimum. For animals in need of longer-term rehabilitation, behavioural conditioning may be required to reduce stress during medical and husbandry procedures, but this conditioning must be used for the shortest time necessary and must be eliminated prior to release (Geraci and Lounsbury 2005).

4. The release candidate does not pose risks to wild populations or their environment or to public safety

The primary risk to wild populations potentially associated with the release of a rehabilitated marine mammal is the introduction of a pathogen that was acquired or modified during rehabilitation. Marine mammals may also carry pathogens with zoonotic potential such as *Toxoplasma*, *Giardia*, and *Salmonella*, to name a few. For these reasons, rehabilitators should consider the value of attempting to treat and release an animal brought to a RC with suspicion of an underlying infectious disease.

There is a long and growing list of potential pathogens harboured by marine mammals. Therefore, it is not possible or practical to expect to monitor the presence or absence of all of them in an individual animal that is due to be released. Nonetheless, the attending veterinarian is encouraged to use the full spectrum of diagnostic tools available to assess the health of animals coming to, or leaving, the RC and, especially, to ensure that animals presented in a moribund state or dying while at the RC have a thorough necropsy by a qualified veterinary pathologist. In addition, monitoring and surveillance of the health of wild populations in the region served by the RC can help identify the composition of the normal community of microorganisms and the pathogens that are likely to have undesirable impacts at the release site.

NOAA (2009b) provides a list of infectious "diseases of current concern" for cetaceans, pinnipeds, and sea otters (Table 2). This list can also be used in the Canadian context when veterinarians and animal care personnel are considering a list of potential differential diagnoses in sick marine mammals admitted to a RC.

C. CRITERIA FOR SELECTION OF RELEASE SITE

Once a rehabilitated animal is ready for release, the life history, ecology, physiology, and behaviour of its species must inform the selection of a suitable site and time for its release, thus maximizing the likelihood of its survival. Notwithstanding the specific criteria that follow, approval of the site and time of release by the proper DFO authorities is required.

a. The animal should be released in areas where conspecifics, ideally those of the same genetic stock, are present at that particular time of year. Although in theory an animal from a widely ranging species could be released anywhere within its normal range after due consideration to the time of year and how this influences the distribution of conspecifics, releasing it far from the site of its original capture increases the potential for spreading pathogens that it may carry. Furthermore, at some point, this could be considered a 'translocation', defined as "the deliberate and mediated movement of wild individuals or populations from one part of their range to another" and bringing with it multiple risks (IUCN, 1998; IUCN/SSC 2013). The same may be said of animals found in so-called extralimital locations, far from their normal range, as occurs in some pinnipeds such as harp seals and hooded seals. Animals rescued and rehabilitated from unusual sites for the species should be evaluated for release by an independent expert group on a case-by-case basis.

b. Releasing more than one individual of the same species at the same time may be beneficial to their collective survival.

c. If possible, the site should be appropriate with respect to the normal seasonal distribution of the species and the age and sex classes.

d. The release site should be chosen to minimize the stress imposed on the animal by the length or difficulty of transportation.

e. The site should be in a quiet area and must have minimal human activity such as boat traffic, commercial or recreational fishing, or recreational swimming.

f. The release site must present a relatively healthy ecosystem, e.g., with no evidence of oil spill or harmful algal bloom.

D. RECOMMENDATIONS REGARDING POST-RELEASE MONITORING

Marine mammal rehabilitation is associated with substantial costs, and some may argue that investing in population-wide conservation measures could have greater benefits (Moore et al. 2007). However, regardless of one's position on marine mammal rehabilitation, it is generally agreed that efforts invested in a project should be reflected in its outcome. The post-release identification and monitoring component of a rehabilitation program is the means to quantify as best as possible the outcomes of rehabilitation efforts by assessing the performance of released individuals as well as the impact of their release on wild populations, the environment, and local human communities. Behavioural observations, including movement patterns, foraging behaviour, social interactions, and breeding success, may yield valuable insights into the ability of released individuals to resume their place in the population and environment. Post-release monitoring allows for retroaction on rehabilitation projects and may guide future initiatives. It can provide information on survival rates and precise causes of death, and allow the identification of new threats to the released animals.

By analogy with rehabilitation efforts undertaken for oiled birds, simple release of an adult animal into the wild does not constitute successful rehabilitation. An animal is regarded as

'rehabilitated' if it is subsequently re-sighted among conspecifics, whereas full 'restoration' takes place once the rehabilitated animal breeds (Underhill et al. 1999).

All released animals should have means of being individually identifiable over a long term after release. Depending on the RC's financial resources and the scientific value of the data to be collected, the methods adopted can vary considerably in their sophistication, cost, and difficulty of deployment, from simple photo identification or small tag (e.g., Roto flipper tag) to the use of satellite-linked transmitters for much more detailed information over a much longer continuous period of time. Notwithstanding the methods adopted, an appropriate permit must be obtained from DFO authorities, these methods must be approved by a relevant Animal Care Committee, and they must be applied by people experienced with the procedure and species involved, some requiring the direct involvement or supervision of the attending veterinarian. In addition, the specific factors involved, such as identification numbers, color and position of tags, and frequencies of radio transmitters, must be coordinated through proper DFO authorities with those used in other RCs or by researchers in the general area where the animals are to be released. In regions of Canada where some species of marine mammals are hunted for food, individual identification of rehabilitated animals can also serve as a warning to the hunters that these animals may carry drug residues.

According to NOAA (2009b), appropriate taxa-specific identification and monitoring methods may include:

a. Cetaceans: coloured and numbered tag affixed to the trailing edge of the dorsal fin; detailed photo identification (e.g., scars, colour pattern, shape of dorsal fin), depending on the species and individual; freeze brand; PIT ("passive integrated transponder") tag implantation (provided that there is coordination among RCs and researchers regarding the implantation site); TDR ("time-depth recorder") and GPS ("global positioning system") satellite-linked transmitter affixed to the dorsal fin (or to the dorsal ridge in belugas). As very few data on long-term monitoring of rehabilitated and released cetaceans are available, all efforts should be undertaken to develop comprehensive post-release programs for these animals, including the use of radio- or satellite-linked transmitters.

b. Pinnipeds: coloured and numbered tag affixed to one of the hind flippers; PIT tag implantation (provided that there is coordination among RCs and researchers regarding the implantation site); freeze brand or hot brand; TDR and GPS satellite-linked transmitter glued on the head.

c. Sea otters: coloured and numbered tag affixed to the rear flippers; PIT tag implanted in the right inguinal area; VHF ("very high frequency") transmitter implanted abdominally.

Post-release monitoring should be done for all rehabilitated marine mammals, especially animals of threatened or endangered species for which the more effective monitoring methods may be required (e.g., VHF or satellite-linked transmitters). The release plan should also include a contingency plan to recapture the animal if it appears unable to readjust to freedom. The first 1-2 months after release represent the most likely period during which problems of re-adaptation to the wild may become evident (NOAA 2009b). If possible, the released animal should be monitored during that period.

All released animals found dead should be subjected to necropsy by a qualified veterinary pathologist and results submitted to the proper DFO authorities.

E. ADDITIONAL CONSIDERATIONS

Information on the biodiversity of parasites, microbial fauna, genetic anomalies, disease vectors and reservoir hosts among free-living marine mammals within the geographic region and range where animals are rescued and released (i.e., baseline data) should be obtained regularly in order to monitor the health of wild populations, detect emerging diseases, and, in a worse-case scenario, assess whether diseases or genetic anomalies are being spread or propagated by rehabilitation activities. The scanning wildlife health surveillance program provided by the Canadian Wildlife Health Cooperative is one important service that can be accessed to contribute to this goal.

Considering the costs and efforts involved in rehabilitation and release of marine mammals, along with the interest of the public in release events, some actions should be taken to optimize the impact of this practice. Particularly, the occasion of release events should be used to raise awareness about human-induced threats to the species, while reminding the public that rehabilitation is rarely of direct benefit from a conservation perspective. Engaging the public in monitoring efforts targeting released animals may also stimulate people's interest in marine mammal conservation in addition to assisting the post-monitoring program, although engagement in post-release monitoring efforts must also discourage violations of marine mammal viewing guidelines or laws by unauthorized individuals. Collaboration with the media is a good way to achieve these goals but must be balanced with the need to limit human activity at the release site.

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TABLES

Table 1. Approximate body mass of marine mammals (at weaning and adults) in North American waters for which rehabilitation may be attempted in Canada. Average body mass may vary regionally and, especially, seasonally.

Species	Body mass at weaning (kg)	Body mass of adults (kg)		Reference
-		Female	Male	-
harbour seal	20-29	75-120		Cottrell et al. (2002); Geraci and Lounsbury (2005)
harp seal	25-40	90-150		Chabot and Stenson (2002); Geraci and Lounsbury (2005)
hooded seal	40-45	150-300	200-400	Lavigne and Kovacs (1988); Geraci and Lounsbury (2005)
grey seal	55	100-250	170-400	Geraci and Lounsbury (2005); Bowen et al. (2015)
bearded seal	85 +/- 21	230-300		Gjertz et al. (2000); Geraci and Lounsbury (2005)
ringed seal	9-16	50-70		Geraci and Lounsbury (2005)
northern elephant seal	100-160	600-900	1200-2300	Geraci and Lounsbury (2005)
California sea lion	25	50-110	250-390	Geraci and Lounsbury (2005)
Steller sea lion	89-125	190-350	410-1100	Winship et al. 2001; Geraci and Lounsbury (2005)
northern fur seal	12-14	30-60	180-270	Geraci and Lounsbury (2005)

Species	Body mass at weaning (kg)	Body mass of adults (kg)		Reference
-		Female	Male	-
harbour porpoise	17 – 25	60 – 80		Read 2001; Geraci and Lounsbury (2005)
beluga	200-250	500-900	900-1400	Geraci and Lounsbury (2005); Robeck et al. (2005)
sea otter	10 – 14	16-32	27-45	Geraci and Lounsbury (2005)

Table 2. Infectious diseases of current concern in cetaceans, pinnipeds, and sea otters, according to NOAA (2009b; Appendices D, E, and G, respectively).

-	Viruses	Bacteria	Fungi	Protozoa	Macroparasites
Cetaceans	morbillivirus	brucellosis	-	*Toxoplasma gondii*	anisakids
	poxvirus	*Erysipelothrix*			hepatic trematodes
	papillomavirus	respiratory illness[1]			*Nasitrema*
					lungworms
Pinnipeds	morbillivirus	brucellosis	-	*Cryptosporidium*	helminths
	poxvirus	leptospirosis		*Sarcocystis*	
	adenovirus	mycobacterial disease		*Giardia*	
	calicivirus				
	herpes virus				
	influenza virus				
Sea otters	morbillivirus	brucellosis	Coccidiomycosis	*Toxoplasma gondii*	helminths
	papillomavirus	leptospirosis		*Sarcocystis neurona*	mites
	herpes virus	septicemias		*Giardia*	
		valvular endocarditis[2]			
		dental disease			

[1] e.g., *Staphylococcus aureus*, *Peudomonas aeruginosa*, Gram-negative bacteria.

[2] e.g., *Streptococcus bovis/equinus* complex.